
Irrigation Scheduling

MAYA TER KUILE-MILLER

CACTUS HILL AG CONSULTING, LLC

The background of the slide is a faded, light-colored image of an irrigation system. It shows a long, straight metal pipe supported by a series of vertical posts, stretching across a green field. The sky is a pale, clear blue. The overall aesthetic is clean and professional, with a focus on agricultural technology.

What is Irrigation Scheduling?

- Programming the timing and amount of water applied on a crop.
- Based on:
 - Soil water content and soil capacity to store water.
 - Evapotranspiration rate of the crop at its' current crop growth and tolerance to deficit.
 - Irrigation System capacity and efficiency.

Principles of Scheduling



Understand your SOIL

Texture/Profile

Available Water Holding
Capacity (AWHC)



Know your CROP

Daily Evapotranspiration

Effective rooting depth

Growth Stage

Ability to withstand
water deficit



Update your IRRIGATION SYSTEM

Percent Chart current
and correct

- Pressure
- Flow
- End tower speed

Center Pivot Focus, but principles apply to Furrow, Sideroll, Flood and others



Soil Water Terminology

Saturation Water: is the soil water content where all soil pores are filled (Saturation) and is the water that readily percolates or drains out from the root zone by gravity

Field Capacity (FC): is the amount of water that remains in the soil after all the Saturation Water. Reached in roughly 24 hours in sandy soil, and up to 3 days in heavier (higher clay and organic matter). (Measured in the lab at 0.1 to 0.33 bars)

“Permanent Wilting Point” (PWP): When plants take up all the **Available Water** for a given soil, soil cannot supply any water to keep plants from dying. (Lab measure is at -15 bars)

Available Water Holding Capacity (AWHC or AWC): is the water held between field capacity and permanent wilting point.

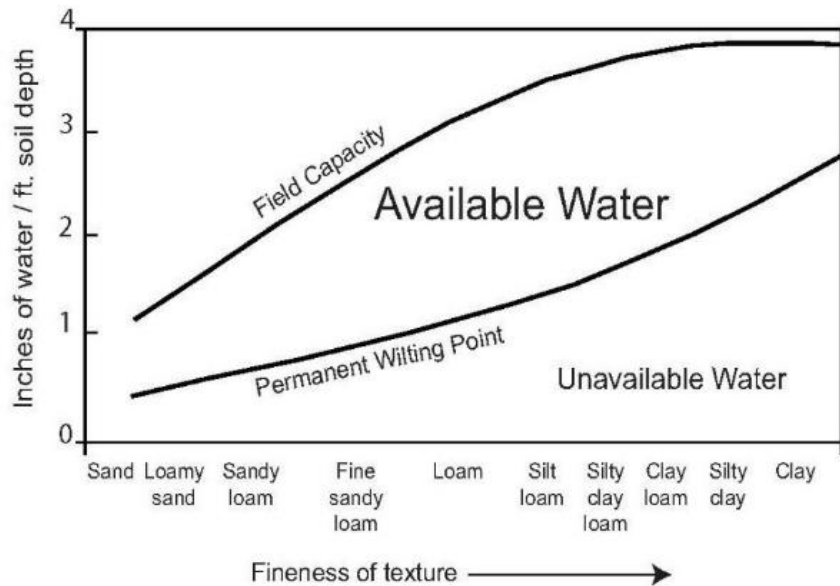
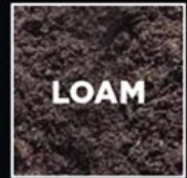


Figure 1. General relationship between soil moisture and texture. Ohio Agronomy Guide, 14th edition, Bulletin 472-05



SAND



LOAM



CLAY



SILT

AVAILABLE WATER CAPACITY BY SOIL TEXTURE

Soil texture is the proportion of small, medium, and large particles (clay, silt, and sand, respectively) in a specific soil mass. For example, a coarse soil is a sand or loamy sand, a medium soil is a loam, silt loam, or silt, and a fine soil is a sandy clay, silty clay, or clay.

Texture	Inches of water storage per foot of soil depth
Coarse sand	.25-.75
Fine sand	.75-1.00
Loamy sand	1.10-1.20
Sandy loam	1.25-1.40
Fine sandy loam	1.50-2.00
Silt loam	2.00-2.50
Silty clay loam	1.80-2.00
Silty clay	1.50-1.70
Clay	1.20-1.50

AWHC and Texture

Dynamic AWHC

Soil Organic Matter 

Compaction 

Salinity/Sodium affected soils 

The Benefits of Higher Organic Matter

- According to most research, a 0.1% increase in organic matter typically results in a roughly 0.15% increase in available water in soils
- 1% increase in organic matter, you can expect around a 1.5% increase in available water capacity in the soil. <https://csanr.wsu.edu/putting-numbers-to-the-difficult-task-of-increasing-soil-organic-matter/>
- Every 1% increase in organic matter results in as much as 25,000 gallons of available soil water per acre.
- Each pound of soil organic matter (SOM) can hold up to 18 to 20 pounds of water and 1% of SOM can hold up to 1 inch of water in the soil. <https://csanr.wsu.edu/putting-numbers-to-the-difficult-task-of-increasing-soil-organic-matter/>

Web Soil Survey (WSS)

<https://websoilsurvey.nrcs.usda.gov/app/>

Web Soil Survey - Home

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Natural Resources Conservation Service

Web Soil Survey

Home About Soils Help Contact Us

You are here: Web Soil Survey Home

The simple yet powerful way to access and use soil data.

START WSS

Welcome to Web Soil Survey (WSS)

Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and...

I Want To...

- Start Web Soil Survey (WSS)
- Know Web Soil Survey Requirements
- Know Web Soil Survey operation hours
- Find what areas of the U.S. have soil data
- Find information by topic
- Know how to hyperlink from...

Search
Enter Keyword
All NRCS Sites

Browse by Subject

- Soils Home
- National Cooperative Soil Survey (NCSS)
- Archived Soil Surveys
- Status Maps
- Official Soil Series Descriptions (OSD)

Calculating Available Water for a given crop

$AW = \text{Root Depth (inches)} \times \text{AWHC}$
(in/in)

AWHC was just explored through Web Soil Survey

What do I need to Know to Schedule Irrigations

- 1. Management Allowed Deficit: MAD for my crop's growth stage**
2. ET for the time period under consideration
Sources:
 - www.coagmet.colostate.edu
 - Agro Engineering
 - Open ET
3. Soil Moisture Status at this moment
4. System characteristics, Efficiencies

Management Allowed Deficit-MAD

- ❑ MAD = The portion of the water that a crop plant can extract from the soil without causing more than acceptable harm (Yield and/or Quality)
- ❑ MAD depends on: Soil type, Crop, Stage of growth

Available Water(AW) = AVAILABLE WATER CAPACITY x ROOTING DEPTH

MAD = % allowable deficit x AW

- Alfalfa: 50%
- Potatoes and vegetable crops: 25-35%
- Small grains: Early boot to flag: 50%, flag to early fill: 40%, Late: 60%
- Sorghum, Millet, Sorghum Sudan and C4 Grasses: 50-60%
- Corn: 50% except 40% during tasseling
- Soybeans, Dry Beans: 40 to 50% except 35-40% during flowering
- Irrigated pasture: 50-60%

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Using CoAgMet: <https://coagmet.colostate.edu/>

The screenshot displays the CoAgMET website interface. At the top, the Colorado State University logo and "COLORADO CLIMATE CENTER | CoAgMET" are visible. The navigation menu includes "CoAgMET", "About", "Daily Maps", "Ag Weather Conditions", "Data Access", and "Graphs & Summaries". Below the menu, there are quick links for "yesterday's summary", "surface map", "precipitation today", and "station pages".

The main content area features a map titled "CoAgMET - Current Temperatures" showing a color-coded map of Colorado with temperature readings at various stations. A color scale at the bottom of the map ranges from -50°F (blue) to 100°F (red). A detailed panel for "Fort Collins AERC" is shown on the right, providing the following information:

- Observation Time: Feb 11, 2026 1:35PM MDT
- Temp/Dewpt: 50.2°F / 22.7°F
- Rel. Humidity: 34%
- Winds: NE 2mph Gust 5mph

Below the panel, there are links to "go to the *ftc01* station page" and "view *ftc01* weather graphs". At the bottom of the page, there are buttons for "air temperature", "dewpoint", "relative humidity", "yesterday's high temp", "yesterday's low temp", "yesterday's max gust", "yesterday's precip", and "yesterday's ETr".

Select your dates and Stations

The screenshot shows the CoAgMET web interface. At the top, there is a navigation bar with the text "UNIVERSITY | COLORADO CLIMATE CENTER | CoAgMET". Below this, there are menu items: "Weather Conditions", "Data Access", and "Graphs & Summaries".

The main content area is titled "S" and contains several selection options:

- Select a Date:** Includes a "Use as" section with radio buttons for "end date" and "start date". Below are dropdown menus for Year (2015-2026), Month (January-December), Day (20-31), and "# to do" (09-120).
- Select Days:** A text instruction: "Hold down the control key to select more than one station".
- Select Stations:** A list of stations with their irrigation status. The list includes: pkh01 - Peckham (Fully Irrigated), pkn01 - Punkin Center (Partially Irrigated), pkr01 - Parker† (Dryland), pnr01 - Penrose (Fully Irrigated), ptv01 - Platteville† (Fully Irrigated), rfd01 - Rocky Ford, AVRC (Fully Irrigated), rfd02 - CSU Expt Stn Rocky Ford NRCS* (Fully Irrigated), san01 - San Acacio (Dryland), sbt01 - Seibert (Dryland), scm01 - Sand Creek Massacre HS (Dryland), slq01 - Salida (Fully Irrigated), slt01 - Silt (Fully Irrigated), stg01 - Sterling (Dryland), and str01 - Stratton (Dryland).

Below the station list, there is a legend for "Irrigation Status Key*" with color-coded boxes: Fully Irrigated (green), Partially Irrigated (yellow), Dryland (brown), and Unknown (white).

At the bottom, there is a section titled "Select Crops and Planting Dates:" with a "Check:" section containing "All" and "None" buttons. Below this are checkboxes for "Alfalfa (Green Up Date)" and "Corn (Plant Date)". For each crop, there are dropdown menus for month (m) and day (d).

The browser's address bar shows the URL "bin/extended_etr_form.pl". The taskbar at the bottom of the screen shows various application icons and the system clock.

Select your crops and enter plant and green-up dates

Select Crops and Planting Date:

Check:

- | | | | | |
|--|---|---------------------------------|---|---------------------------------|
| <input checked="" type="checkbox"/> Alfalfa (Green Up Date) | m | <input type="text" value="04"/> | d | <input type="text" value="24"/> |
| <input type="checkbox"/> Corn (Plant Date) | m | <input type="text" value="04"/> | d | <input type="text" value="20"/> |
| <input type="checkbox"/> Drybeans (Plant Date) | m | <input type="text" value="05"/> | d | <input type="text" value="31"/> |
| <input checked="" type="checkbox"/> GrassHay (Green Up Date) | m | <input type="text" value="04"/> | d | <input type="text" value="15"/> |
| <input checked="" type="checkbox"/> Smallgrn (Plant Date) | m | <input type="text" value="04"/> | d | <input type="text" value="06"/> |
| <input type="checkbox"/> Sgrbeets (Plant Date) | m | <input type="text" value="04"/> | d | <input type="text" value="08"/> |
| <input type="checkbox"/> Potatoes (Plant Date) | m | <input type="text" value="06"/> | d | <input type="text" value="03"/> |
| <input type="checkbox"/> Onion/sd (Plant Date) | m | <input type="text" value="03"/> | d | <input type="text" value="22"/> |
| <input type="checkbox"/> WntrWheat (Green Up Date) | m | <input type="text" value="03"/> | d | <input type="text" value="01"/> |
| <input type="checkbox"/> Tomato (Plant Date) | m | <input type="text" value="05"/> | d | <input type="text" value="15"/> |
| <input type="checkbox"/> Peach (Green Up Date) | m | <input type="text" value="04"/> | d | <input type="text" value="01"/> |
| <input type="checkbox"/> Apple (Green Up Date) | m | <input type="text" value="04"/> | d | <input type="text" value="10"/> |
| <input type="checkbox"/> Cherry (Green Up Date) | m | <input type="text" value="04"/> | d | <input type="text" value="03"/> |
| <input type="checkbox"/> Grape (Green Up Date) | m | <input type="text" value="05"/> | d | <input type="text" value="01"/> |
| <input type="checkbox"/> Cool Season Turf | | | | |

Reference ET Model:

- Penman-Kimberly
 ASCE Standardized Daily
 ASCE Standardized Hourly

Format

- Web page (HTML)
 Comma-Separated Values (CSV)

The **crop coefficients** used to generate crop ET reports were developed for the Penman-Kimberly model. Selection of another model is only

Crop Growth Stage

Built in to CoAgMet somewhat = “Crop Coefficients”

Field verification involves estimating the percent cover

Percent cover X Potential ET = Actual ET for that growth stage

Many crops, particularly corn, beans, and small grains DO NOT LIKE early overwatering!



What factors affect ET

1. Solar Radiation: Energy from the sun
2. Temperature
3. Wind
4. Humidity
5. Crop
6. Stage of Growth: Crop Coefficients
7. Soil moisture and salinity
8. Stand density, plant nutrition, crop variety etc.

Week of July 1 to July 10							
<u>Date</u>	<u>Alfalfa</u>	<u>GrassHay</u>	<u>Smallgrn</u>	<u>Potatoes</u>	<u>ETr</u>	<u>ETo</u>	<u>Precip</u>
7/1/2023	0.31	0.27	0.26	0.27	0.31	0.24	0
7/2/2023	0.27	0.24	0.22	0.24	0.27	0.22	0
7/3/2023	0.31	0.27	0.25	0.28	0.31	0.25	0
7/4/2023	0.28	0.25	0.22	0.25	0.28	0.23	0
7/5/2023	0.3	0.26	0.23	0.27	0.3	0.24	0
7/6/2023	0.39	0.34	0.28	0.35	0.39	0.3	0
7/7/2023	0.39	0.34	0.27	0.35	0.39	0.3	0
7/8/2023	0.39	0.34	0.25	0.35	0.39	0.3	0
7/9/2023	0.31	0.27	0.19	0.28	0.31	0.24	0
7/10/2023	0.27	0.23	0.16	0.24	0.27	0.22	0

How weather affects ET

		T Max	T Min	Wind Run	Precip	Wind Gusts	Ref ET
Month	Day	°F	°F	Mi/Day	In	mph	ASCE
7	1	81.4	41.5	126.6	0	7.8	0.30
7	2	80.2	47.2	146.5	0	20.7	0.28
7	3	84.2	44.2	130.9	0	9.0	0.31
7	4	82.7	48.2	154.3	0	16	0.29
7	5	84.4	46.2	249.6	0	20	0.34
7	6	83.0	41.7	264.7	0	17.2	0.40
7	7	85.2	45.1	232	0	18.2	0.39
7	8	84.9	45.2	258.8	0	18.0	0.40
7	9	86.2	43.9	123.2	0	8.2	0.30
7	10	81.8	49.8	152.7	0	11.8	0.28

Adjustments

Hot and Windy—Use Max ET numbers

Cloudy afternoon: Use $\frac{2}{3}$ of Max ET

Cloudy all day: Use $\frac{1}{2}$ of Max ET

But remember you can always get info off the web for ET from CoAgMet stations

And always check you soils: Auger, shovel, sensors

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Verifying Moisture

- Shovel, Auger, field check
 - Using the “Feel Method”
- Moisture Sensors
 - Tensiometers or Gypsum Blocks
 - Capacitance probes
 - Autonomous Pivot



TACOMA

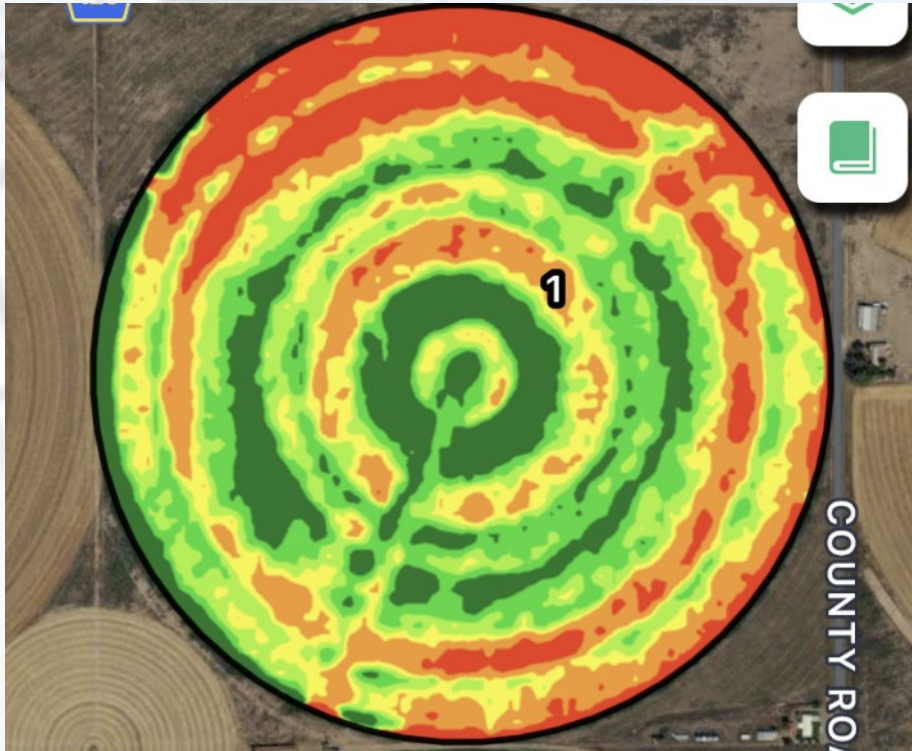
Oakfield Auger Bits



AMS Sampling Equipment



Positioning Moisture Sensors



- Original software recommended placing sensors based on soil type
- I recommend the start position, outer 2 spans
- Position sensors away where the nozzle spray will reach them when the system starts
- **If you have nozzling issues, sensors may be inaccurate**

Feel Method

USDA
Natural Resources Conservation Service
United States Department of Agriculture

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Search results for "estimating soil Moisture"

Publications/Forms 1 - 2 displayed.
2 total matching your criteria.

No.	Publication/Form
PA-1619	Estimating Soil Moisture by Feel and Appearance PA-1619 is a guide to estimate soil moisture t
PA-1619-SP	Estimando Sol Moisture-Calculo De La Humedad PA-1619-SP, Calculo De La Humedad del Suelo Moisture by Feel And Appearance brochure. (

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41.3.0 (NRCPDS-PA4518)

Appearance of fine sand and loamy fine sand soils at various soil moisture conditions.

Available Water Capacity 0.6-1.2 inches/foot

Percent Available: Currently available soil moisture as a percent of available water capacity.

In./ft. Depleted: Inches of water currently needed to refill a foot of soil to field capacity.

0-25 percent available
1.2-0.5 in./ft. depleted

Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure. (Not pictured)



50-75 percent available
0.6-0.2 in./ft. depleted

Moist, forms a weak ball with loose and aggregated sand grains on fingers, darkened color, moderate water staining on fingers, will not ribbon.



25-50 percent available
0.9-0.3 in./ft. depleted

Slightly moist, forms a very weak ball with well-defined finger mark



75-100 percent available
0.3-0.0 in./ft. depleted

Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon

100 percent available
0.0 in./ft. depleted (field capacity)

Wet, forms a weak ball, moderate to heavy soil/water coating on fingers, wet outline of soft ball remains on hand. (Not pictured)

Feel Method

	Coarse Texture— Fine Sand and Loamy Fine Sand	Moderately Coarse Texture— Sandy Loam and Fine Sandy Loam	Medium Texture—Sandy Clay Loam, Loam, and Silt Loam	Fine Texture—Clay, Clay Loam, or Silty Clay Loam
Available Water Capacity (Inches/Foot)				
	0.6-1.2	1.3-1.7	1.5-2.1	1.6-2.4
Available Soil Moisture Percent	Soil Moisture Deficit (SMD) in inches per foot when the feel and appearance of the soil are as described.			
0-25	Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure. SMD 1.2 - 0.5	Dry, forms a very weak ball, ¹ aggregated soil grains break away easily from ball. SMD 1.7 - 1.0	Dry, soil aggregations break away easily, no moisture staining on fingers, clods crumble with applied pressure. SMD 2.1 - 1.1	Dry, soil aggregations easily separate, clods are hard to crumble with applied pressure. SMD 2.4 - 1.2
25-50	Slightly moist, forms a very weak ball with well-defined finger marks, light coating of loose and aggregated sand grains remain on fingers. SMD 0.9 - 0.3	Slightly moist, forms a weak ball with defined finger marks, darkened color, no water staining on fingers, grains break away. SMD 1.3 - 0.7	Slightly moist, forms a weak ball with rough surfaces, no water staining on fingers, few aggregated soil grains break away. SMD 1.6 - 0.8	Slightly moist, forms a weak ball, very few soil aggregations break away, no water stains, clods flatten with applied pressure. SMD 1.8 - 0.8
50-75	Moist, forms a weak ball with loose and aggregated sand grains on fingers, darkened color, moderate water staining on fingers, will not ribbon. ² SMD 0.6 - 0.2	Moist, forms a ball with defined finger marks, very light soil/water staining on fingers, darkened color, will not slick. SMD 0.9 - 0.3	Moist, forms a ball, very light water staining on fingers, darkened color, pliable, forms a weak ribbon between thumb and forefinger. SMD 1.1 - 0.4	Moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger. SMD 1.2 - 0.4
75-100	Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon. SMD 0.3 - 0.0	Wet, forms a ball with wet outline left on hand, light to medium water staining on fingers, makes a weak ribbon between thumb and forefinger. SMD 0.4 - 0.0	Wet, forms a ball with well defined finger marks, light to heavy soil/water coating on fingers, ribbons between thumb and forefinger. SMD 0.5 - 0.0	Wet, forms a ball, uneven medium to heavy soil/water coating on fingers, ribbons easily between thumb and forefinger. SMD 0.6 - 0.0
Field Capacity (100 percent)	Wet, forms a weak ball, moderate to heavy soil/water coating on fingers, wet outline of soft ball remains on hand. SMD 0.0	Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers. SMD 0.0	Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers. SMD 0.0	Wet, forms a soft ball, free water appears on soil surface after squeezing or shaking, thick soil/water coating on fingers, slick and sticky. SMD 0.0

So... where do I check?

At the Start Position



In Front of the sprinkler

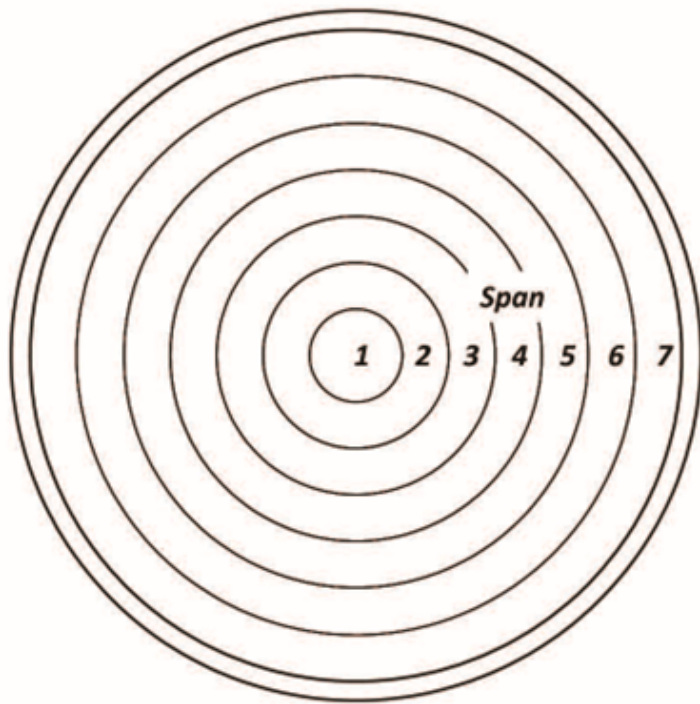


If you have concerns, at the stop position



On a sprinkler: Outer 2, maybe 3 spans

So... where do I check?



Span	Span end, ft	Area within the span, acres	Discharge from span gpm
1	180	2	14
2	360	7	42
3	549	12	71
4	720	16	99
5	900	21	127
6	1080	26	156
7	1269	39	184
O. Hang	1310	9	56
Total		124	750

Figure L-1. Characteristics of a typical center pivot. (Note that 45% of the land area is under the outer two spans while only about 7% of the land is under the first two spans.)

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Irrigation Efficiencies

Defined as the Percent of the water applied in an irrigation that goes to crop evapotranspiration

Sprinklers: 80% to 95%

- Depends on nozzling, height, runoff

Sideroll: 60 to 85%

Surface/Flood: 35% to 60%

Wild Flood/Meadows: Depends on water distribution

For Sprinklers and Sideroll: Current Percent vs. Depth Chart?

- Correct Flow?
 - Design Flow is often NOT the actual
 - Nozzle charts are often based on un-tested flow and pressure
- Correct Pressure?
 - Well Problems/declining water will manifest here!!!
 - Pattern problems
 - Biggest impact will be on the outer 2 to 3 spans
- Center Drive Changes?
 - Gearbox went out, center drive replaced with something off an old sprinkle or the shelf in the shop?
 - Ground was rented out (carrots and lettuce growers will put in super fast gearboxes)

John Smith

XYZ

Irrigation Depth Chart

7-Jul-23

DEPTH	TRUE PERCENT	DIAL SETTING	HOURS
(in)	(%)	(%)	(hrs)
0.18	100	100	10.7
0.20	91	91	11.7
0.25	73	73	14.7
0.30	61	61	17.6
0.35	52	52	20.5
0.40	45	45	23.5
0.50	36	36	29.4
0.60	30	30	35.2
0.65	28	28	38.2
0.70	26	26	41.1
0.75	24	24	44.0
0.80	23	23	47.0
0.85	21	21	49.9
0.90	20	20	52.8
1.00	18	18	58.7
1.10	17	17	64.6
1.20	15	15	70.4
1.30	14	14	76.3
1.40	13	13	82.2
1.50	12	12	88.1
1.6	11	11	93.9

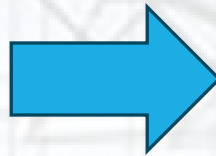
Use DIAL SETTING for correct depth

DATA IS WITH END GUN OFF

System FlowRate:	900.0	Flow Test?:	CHAC
Pressure ON TOP:	32.0	Irrigated Acreage:	117
Distance to Tower 8:	1238.3	Minimum Depth:	0.18
Effective Reach:	1271.7	Fastest Circle:	10.7
Static Water Level:	0.0	50 ft Time @100%:	4.1
Pumping Water Level:	0.0	20% Time:	12.00
System KW Demand:	0.0	50% Time:	30.00
Percent of Circle Irrig:	100%	Cycle Time:	60.00

Provided by Cactus Hill Ag Consulting, LLC

Pressure Drop



John Smith

XYZ

Irrigation Depth Chart

7-Jul-23

DEPTH	TRUE PERCENT	DIAL SETTING	HOURS
(in)	(%)	(%)	(hrs)
0.15	100	100	10.7
0.20	75	75	14.2
0.25	60	60	17.7
0.30	50	50	21.2
0.35	43	43	24.8
0.40	38	38	28.3
0.50	30	30	35.4
0.60	25	25	42.5
0.65	23	23	46.0
0.70	21	21	49.6
0.75	20	20	53.1
0.80	19	19	56.7
0.85	18	18	60.2
0.90	17	17	63.7
1.00	15	15	70.8
1.10	14	14	77.9
1.20	13	13	85.0
1.30	12	12	92.1
1.40	11	11	99.2
1.50	10	10	106.2
1.6	9	9	113.3

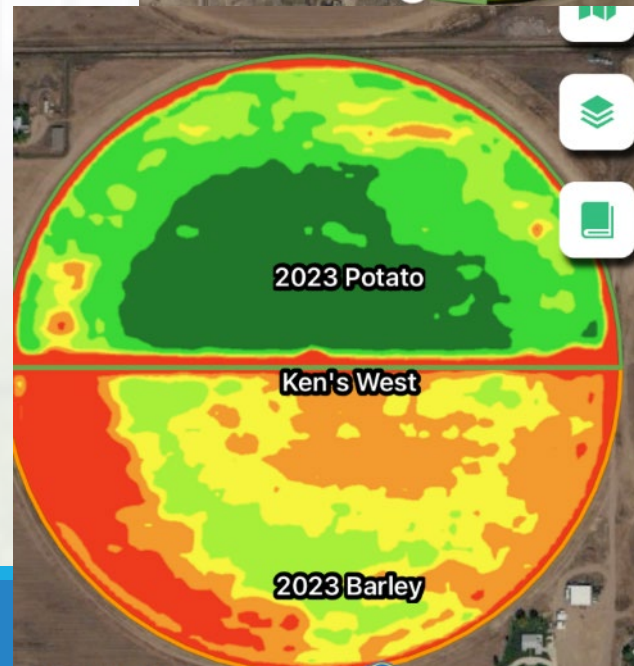
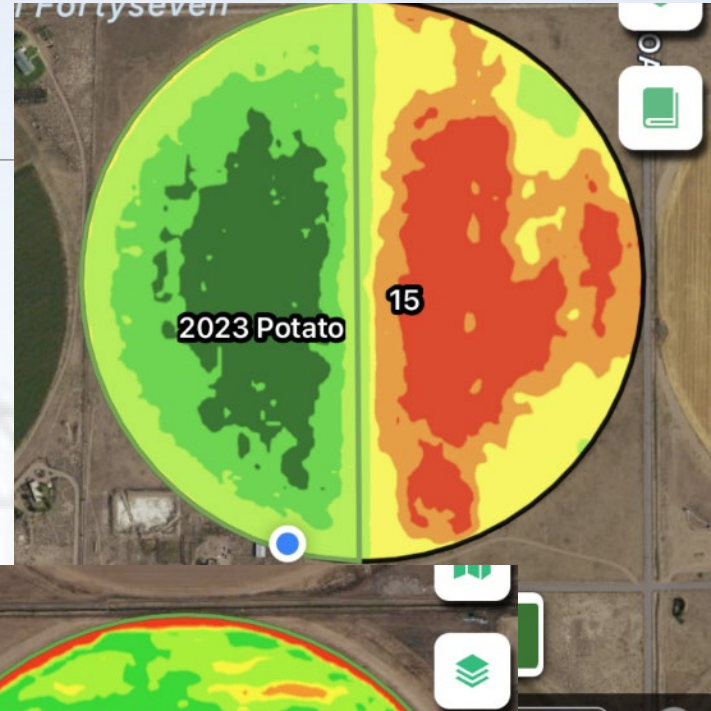
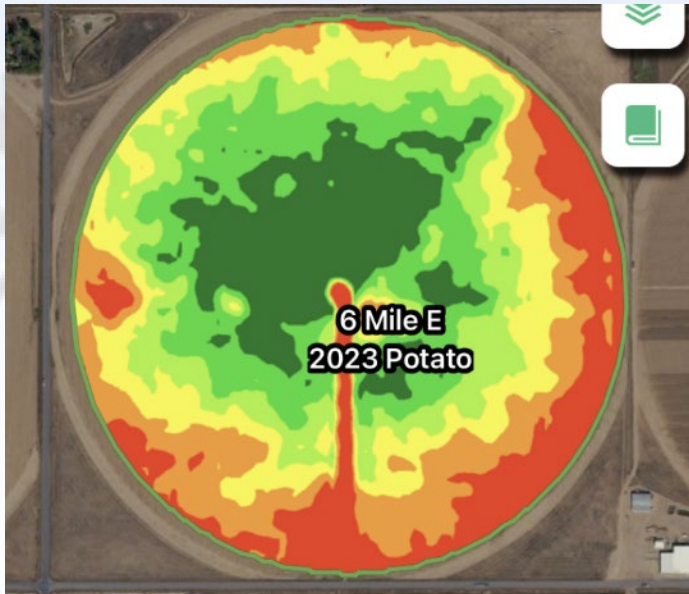
Use DIAL SETTING for correct depth

DATA IS WITH END GUN OFF

System FlowRate:	746.0	Flow Test?:	CHAC
Pressure ON TOP:	22.0	Irrigated Acreage:	117
Distance to Tower 8:	1238.3	Minimum Depth:	0.15
Effective Reach:	1271.7	Fastest Circle:	10.7
Static Water Level:	0.0	50 ft Time @100%:	4.1
Pumping Water Level:	0.0	20% Time:	12.00
System KW Demand:	0.0	50% Time:	30.00
Percent of Circle Irrig:	100%	Cycle Time:	60.00

Provided by Cactus Hill Ag Consulting, LLC

Effects of Low Pressure



John Smith

XYZ

Irrigation Depth Chart

7-Jul-23

DEPTH	TRUE PERCENT	DIAL SETTING	HOURS
(in)	(%)	(%)	(hrs)
0.18	100	100	10.7
0.20	91	91	11.7
0.25	73	73	14.7
0.30	61	61	17.6
0.35	52	52	20.5
0.40	45	45	23.5
0.50	36	36	29.4
0.60	30	30	35.2
0.65	28	28	38.2
0.70	26	26	41.1
0.75	24	24	44.0
0.80	23	23	47.0
0.85	21	21	49.9
0.90	20	20	52.8
1.00	18	18	58.7
1.10	17	17	64.6
1.20	15	15	70.4
1.30	14	14	76.3
1.40	13	13	82.2
1.50	12	12	88.1
1.6	11	11	93.9

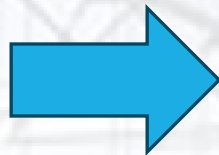
Use DIAL SETTING for correct depth

DATA IS WITH END GUN OFF

System FlowRate:	900.0	Flow Test?:	CHAC
Pressure ON TOP:	32.0	Irrigated Acreage:	117
Distance to Tower 8:	1238.3	Minimum Depth:	0.18
Effective Reach:	1271.7	Fastest Circle:	10.7
Static Water Level:	0.0	50 ft Time @100%:	4.1
Pumping Water Level:	0.0	20% Time:	12.00
System KW Demand:	0.0	50% Time:	30.00
Percent of Circle Irrig:	100%	Cycle Time:	60.00

Provided by Cactus Hill Ag Consulting, LLC

Change in Center Drive



John Smith

XYZ

Irrigation Depth Chart

7-Jul-23

DEPTH	TRUE PERCENT	DIAL SETTING	HOURS
(in)	(%)	(%)	(hrs)
0.12	100	100	6.9
0.20	59	59	11.7
0.25	47	47	14.7
0.30	39	39	17.6
0.35	33	33	20.5
0.40	29	29	23.5
0.50	23	23	29.4
0.60	20	20	35.2
0.65	18	18	38.2
0.70	17	17	41.1
0.75	16	16	44.0
0.80	15	15	47.0
0.85	14	14	49.9
0.90	13	13	52.8
1.00	12	12	58.7
1.10	11	11	64.6
1.20	10	10	70.4
1.30	9	9	76.3
1.40	8	8	82.2
1.50	8	8	88.1
1.6	7	7	93.9

Use DIAL SETTING for correct depth

DATA IS WITH END GUN OFF

System FlowRate:	900.0	Flow Test?:	CHAC
Pressure ON TOP:	32.0	Irrigated Acreage:	117
Distance to Tower 8:	1238.3	Minimum Depth:	0.12
Effective Reach:	1271.7	Fastest Circle:	6.9
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Pumping Water Level:	0.0	20% Time:	12.00
System KW Demand:	0.0	50% Time:	30.00
Percent of Circle Irrig:	100%	Cycle Time:	60.00

Provided by Cactus Hill Ag Consulting, LLC

Keep track of RAIN



Putting it all together: How do I ACTUALLY Schedule

What is my MAD? What irrigation depth will I use?

MAD = Root Depth X AWHC X Percent MAD

- **MAD / Irrigation Efficiency = Irrigation Depth**

How long since I last irrigated: in days

What is ET for those days

What is the rainfall over 0.1 inches

Calculate (and do a field check): **Deficit = ET x days – precip**

When I hit my MAD: Irrigate

Typical Irrigation depth (Sprinklers)

Alfalfa and irrigated pasture:

- New stand after planting: .4 inches
- Established stand:
 - 0.8 inches to 1.8 inches

Potatoes, soybeans, dry beans, peas and some vegetables:

- First irrigation or Pre-Water: Wet entire profile
- Rest of irrigations: .5 to 1.0 inches

Small grains and small seeded vegetables:

- Early: keep seed wet for germination, Break Crust, incorporate fertilizer
- Later: 0.5 to 1.2 depending on soil type

Putting it all together: EXAMPLE

What is my MAD? What irrigation depth will I use?

MAD = Root Depth X AWHC X Percent MAD

Example: Dry Beans at bloom in Montrose: 16 inches X 0.16 in/in X (40/100) = 1.02 inches

MAD / Irrigation Efficiency = Irrigation Depth

In the example: 1.02 inches/0.90 = 1.15

How long since I last irrigated in days: 4 days

What is ET for those days: 0.3, 0.3, 0.15, 0.24 = total of 0.99

What is the rainfall over 0.1 inches: Example = 0.2

Calculate (and do a field check): Deficit = ET x days – precip Example = (0.99 in 4 days) - 0.2 rain = 0.79 current deficit

When I hit my MAD: Irrigate

Deficit is 0.79 Currently, weather supposed to be windy and dry today so ET will likely be 0.3, MAD will be reached so start irrigation pm.

Keep track of your "Checkbook"

July	4	5	6	7	8	9	10	11	12	13
Field	Mon	Tues	Weds	Thurs	Fri	Sat	Sun	Mon	Tues	Weds
GV1 Wheat W/Barley+Peas		0.8 am FM	0.8 pm Wh		0.8 am FM	0.8 pm Wh		0.8 am FM	0.8 pm Wh	
GV2 Wheat W/Barley+Peas		0.8 pm FM	0.8 pm Wh		0.8 pm FM	0.8 pm Wh		0.8 pm FM	0.8 pm Wh	
R1 Org Alfalfa		1.0 am				1.2 am				1.2 am
31 Canola	0.8 am			0.8 am			0.8 am			0.8 am
32		1.0 am				1.0 am				1.0 am
33 Alfalfa Org Trans		1.0 am				1.2 am				1.2 am
34 Alfalfa		1.0 am				1.2 am				1.2 am
35 Barley	0.8 am			0.7 am			0.7 am			0.7 am
37 Alfalfa/IRG		1.0 am				1.2 am				1.2 am
38 Barley	0.7 am to S			0.7 am to N			0.7 am to S			0.7 am to N
Carlson Canola			final N? 20? 0.8 pm			0.8 pm			0.8 pm	
RL 1 Pasture Grass?	1.0 am			1.0 pm				1.0 am		
RL 2 Pasture Grass?			1.0 am			1.0 pm				1.0 am

On the fly adjustments

1. **MEMORIZE THIS!!!**

$$Q_{\text{(GPM)}} T_{\text{(hrs)}} = 453 A_{\text{(acres)}} D_{\text{(In.)}}$$

This is the basis for all percent charts

2. Adjusting for Pressure change:

$$\sqrt{\frac{\text{Pressure}_{\text{New}}}{\text{Pressure}_{\text{Old}}}} * \text{Old Flow (GPM)} = \text{APPROX NEW FLOW}$$

The Math

$$\sqrt{\frac{\text{Pressure}_{\text{New}}}{\text{Pressure}_{\text{Old}}}} * \text{Old Flow (GPM)} = \text{APPROX NEW FLOW}$$

1. ADJUST FLOW

$$22 \div 32 = 0.875$$

$$\sqrt{0.6875} = 0.83$$

$$0.83 \times 900 = 746 \text{ GPM}$$

$$Q_{\text{(GPM)}} T_{\text{(HRS)}} = 453 A_{\text{(ACRES)}} D_{\text{(IN.)}}$$

2. Adjust irrigation depth

You need to apply 0.7"

$$T_{\text{(hrs)}} = (453 \times A \times D) \div Q$$

$$T_{\text{(hrs)}} = (453 \times 117 \times 0.7) \div 746$$

$$T = 49.7 \text{ Hrs}$$

3. ADJUST PERCENT TIMER:

Cheat and look up the time on the old chart, 21% Or

Adjust your 100% depth using the above Equation:

$$D = Q \times T / 453 \times A \quad D = (746 \times 10.7) \div 453 \times 117 \quad D = 0.15$$

$$\% \text{ SETTING} = 0.15 / 0.7 \times 100 = 21\%$$

A wide-angle photograph of a vast field of purple flowers with yellow centers, likely a potato field. The flowers are densely packed and stretch towards the horizon. The background shows a range of mountains under a blue sky with scattered white clouds. The overall scene is bright and sunny.

Questions?

Contact Information

Maya ter Kuile-Miller

Cactus Hill Ag Consulting, LLC

20758 County Road 10

La Jara, CO 81140

Cell: (719) 580-1976

mayatk30@gmail.com

cactushillag@gmail.com